CLASSIFICATION CONFIDENTIAL CONFIDENTIAL

50X1-HUM

CENTRAL INTELLIGENCE AGENCY
INFORMATION FROM
FOREIGN DOCUMENTS OR RADIO BROADCASTS

REPORT

CD NO.

| | | | |
|---|---|---|---|
| COUNTRY | USSR | DATE OF INFORMATION | 1949 |
| SUBJECT | Scientific - Electricity, capacitors, power factor | DATE DIST. | 11 Oct 1951 |
| HOW PUBLISHED | Monthly periodical | | |
| WHERE PUBLISHED | Moscow | NO. OF PAGES | 14 |
| DATE PUBLISHED | Nov 1949 | SUPPLEMENT TO REPORT NO. | |
| LANGUAGE | Russian | | |



THIS IS UNEVALUATED INFORMATION

SOURCE Elektrichestvo, No 11, 1949, pp 10-19.

# SOVIET CAPACITOR CONSTRUCTION AND ITS IMMEDIATE PROBLEMS

M. M. Morozov, Cand Tech Sci
Condenser Plant, Ministry of Elec Industry
Submitted 12 August 1949

(Elektrichestvo abstract: The use of capacitors, especially high-voltage capacitors, has grown enormously in electric engineering and many other fields. The wide r[illegible] of technical requirements has made necessary the construction of many different types of capacitors. The present status of Soviet capacitor construction to meet high-current requirements is briefly reviewed and the basic problems involved in construction and in scientific research are set forth.)

As a rule, paper impregnated with a liquid or semiliquid is used as a dielectric for capacitors which are to be used for high currents.

The most difficult conditions for capacitor insulation arise during the continuous action of an alternating voltage. In rectified voltage circuits, pulse systems, etc., working conditions are easier.

High-current capacitors may be divided, according to the difficulty of their operating conditions, into the following groups:

1. Capacitors for power-factor improvement in normal ac circuits, for overvoltage protection, for voltage regulation, and for periodically discharging oscillatory circuits.

2. Capacitors for high-frequency filter protection of high-voltage transmission lines and for communication along transmission lines, and shunting capacitors for high-voltage dc transmission lines.

3. High-frequency (up to 10 kc) for smelting, heating, and hardening equipment.



CONFIDENTIAL

CLASSIFICATION CONFIDENTIAL

| STATE | X | NAVY | X | NSRB | | DISTRIBUTION | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ARMY | X | AIR | X | FBI | | | | | | | |

Sanitized Copy Approved for Release 2011/09/21 : CIA-RDP80-00809A000700010567-0

CONFIDENTIAL

power per unit. While a 90-kva unit is required in order to test a 10-kilovar capacitor, under triple test voltage, the power of the testing unit will reach 900 kva when the power of the capacitor is 100 kilovars.

At present, take 10 kilovars for impregnation with oil or 15 kilovars for impregnation with sovol as the basic unit of a group of capacitors for power factor improvement at normal frequency. This is more convenient than the prewar units of 6 and 21 kilovars and permits production in large series.

As a general rule, it is advisable to produce large units for voltages of 3, 6, and 10 kv.

Table 1 gives basic data on a group of capacitors for kilovar supply of the first standard size being produced at present The characteristics of prewar capacitors are also given for comparison.

/See table on following page./



CONFIDENTIAL

Table 1

| Type | Yr of Production | Voltage (kv) | Capacitance (μfd) | Power (kvar) | Size of Case (mm) | Wt (kg) | Kg/kvar | Cu dm/kvar | Sq dm/kvar | Cost per kvar (rubles) |
|---|---|---|---|---|---|---|---|---|---|---|
| KM10-10-1 | 1948 | 10 | 0.38 | 10 | 380 x 110/350 | 23 | 2.30 | 1.46 | 3.43 | 76 |
| KM6-10-1 | 1948 | 6 | 1.0 | 10 | 380 x 110/350 | 23 | 2.30 | 1.46 | 3.46 | 76 |
| KM3-10-1 | 1948 | 3 | 4.2 | 10 | 380 x 110/350 | 23 | 2.30 | 1.46 | 3.46 | 76 |
| KM0.5-8-3 | 1948 | 0.5 | 110.0 | 8 | 380 x 110/350 | 23 | 2.87 | 1.82 | 4.3 | 145 |
| KM0.38-5-3 | 1948 | 0.38 | 110.0 | 5 | 380 x 110/350 | 23 | 4.60 | 2.92 | 7.0 | 225 |
| KM0.22-3-3 | 1948 | 0.22 | 220.0 | 3 | 380 x 110/350 | 23 | 7.7 | 4.86 | 11.4 | 380 |
| KRM6-1* | 1937 | 6 | 0.62 | 6.8 | 315 x 110/315 | 21 | 3.08 | 1.6 | 3.93 | -- |
| KOM21/6** | 1940 | 6 | 1.85 | 21 | 400 x 185/585 | 74 | 3.5 | 2.06 | 3.2 | -- |

* Produced in the prewar period by the KZETA (Kiev Plant of Industrial Electrical Equipment).

** Produced in the prewar period by the MTZ (Moscow Transformer Plant).

From conditions governing unification of individual parts of the capacitor (the casing, in particular), we can outline an approximate scale of typical powers for capacitors of the second size as shown in Table 2.

Larger units of the order of 100 or more kilovars must be manufactured individually under special specifications.

To regulate voltage in transmission lines with the aid of capacitor batteries, the use of standard single-phase 3-, 6-, and 10-kv capacitors connected in series is proposed. These would have the proper insulation with respect to ground. In this case, there would be no need for making ac capacitors for voltages higher than 10 kv. Selection of a maximum power of 40 kilovars for a series-produced capacitor (Table 2) is based on the fact that, up to this power, it is possible to manufacture capacitors in smooth welded containers without expanders and without hermetic sealing, i.e., with welded covers. This is an economical design and operates very reliably in comparison with capacitors in which the cover is attached to the case by means of gaskets and bolts.

Table 2. Typical Powers Contemplated in the Manufacture of Condensers for Kilovar Supply in Industrial Networks (Second Standard Size)

| Voltage (v) | Power (kvar) Impregnated With Mineral Oil | Impregnated With Sovol | No of Phases |
|---|---|---|---|
| 220 | 5 | 10 | 3 |
| 380 | 10 | 15 | 3 |
| 500 | 20 | 30 | 3 |
| 3,000 | 25 | 40 | 1 and 3 |
| 6,000 | 25 | 40 | 1 and 3 |
| 10,000 | 25 | 40 | 1 and 3 |

The expenditure of paper per kva for a working voltage of 220 v is approximately three times that for 3, 6, and 10 kv. The man-hours required per kva at low voltage is also several times greater than at high voltages. Finally, the production efficiency of the main equipment calculated in kva is also 3.3 times higher for the production of high-voltage capacitors than for 220-v capacitors. These factors and the price of 7-8 micron capacitor paper make the cost of low-voltage capacitors considerably higher than that of high-voltage capacitors. As a result, it is considerably more efficient to produce high-voltage capacitors.

In developing plans for kilovar supply of many large systems, some planning organizations are inclined to recommend the use of low-voltage capacitors. For example, the construction of 380-v compensating units with a power of 30,000-40,000 kilovars is planned in one of the systems. In the final analysis, the ratio of low-voltage capacitors to the total factory output must be determined by the voltage requirements of the consumer. We strongly recommend making a careful technical and economic survey of voltage requirements based on the general interests of the government in allocating kilovar supply sources. This study should include not merely the comparative cost per kilovar of low- and high-voltage capacitors, but also the most advantageous use of materials and production capacity in manufacturing static capacitors. There seems to be insufficient basis for the idea that low-voltage capacitors are more reliable in operation than high-voltage capacitors: defects in capacitor paper have a greater effect on the operation of low-voltage capacitors owing to the small number of paper layers in them and to these layers' very large capacitance. Where smooth regulation and distribution of active and reactive loads for networks of transmission lines is desired, it is preferable to install large high-voltage regulated capacitor batteries switched on and off at the discretion of the dispatchers of the power system. Hence, it is to be expected that use of low-voltage capacitors for power-factor improvement should temporarily be limited to cases where it is absolutely necessary.

50X1-HUM

CONFIDENTIAL

CONFIDENTIAL

To increase the reliability of postwar capacitors for power-factor improvement, the design was revised and the working gradient was decreased. The seams of the casing are welded instead of soldered, thus increasing their mechanical strength. Changes have been made in the working parts of capacitors to improve cooling.

The specific characteristics of the postwar series according to such indexes as weight and volume per kilovar are higher than those of prewar capacitors. Comparing the prewar KPM6-1 of the KZETA Plant with the KM6-10-1, we see that the power of the latter has been increased 66% while its volume has increased only 30%, although the working gradient of the design was reduced from 14 kv/mm in 1938 to 12 kv/mm in 1948. Such capacitor characteristics as the loss angle and insulation resistance are sufficiently high in the postwar series and meet contemporary requirements.

The manufacture in the USSR of equipment for induction smelting, heating and hardening required the development of high-current capacitors for a wide range of frequencies and voltages. In the prewar period, capacitors of one standard size were built for induction-arc furnaces for frequencies of 500 to 2,000 cycles at voltages of 1,500 to 3,000 v with a power of 12-14 kilovars per unit. At present, capacitors are being produced for 500, 1,000, 2,000, 2,500 and 8,000 cycles with voltages ranging from 375 to 3,000 v and powers from 10 to 150 kilovars.

The construction of assembly lines in various branches of industry and the inclusion of surface hardening installations in these lines compelled the makers of capacitors to greatly reduce the area and volume previously required for capacitor batteries in such installations. This was effected by new designs using water cooling to eliminate heat when the capacitor dielectric was heavily loaded.

Figure 1 /figures not reproduced here are available in the original in CIA/ shows a group of seven furnace capacitors for a voltage of 1,500 v and a frequency of 2,000 cycles with natural cooling and one capacitor for the same voltage and frequency with water cooling which is equivalent to the group.

In a capacitor with forced cooling, a container with two walls is used instead of the ordinary heavy and expensive coiled pipe. This design was suggested by S. K. Medvedev. It makes it possible to connect the cooling system of two or three capacitors in series and does not require any special purification of the water or increase in pressure. It also greatly reduces the weight of the capacitor. These capacitors can be built in sections and the individual sections can be connected in parallel or in series. Hence, they can operate at two voltage levels. Depending on frequency and voltage, the power of capacitors of this size varies from 70 to 140 kilovars. The use of sovol instead of mineral oil as an impregnant can increase the power for the same capacitor size another 30-40% in some frequency ranges. In addition to its other advantages, the use of forced cooling greatly reduces the cost per kilovar of the capacitor.

Table 3 gives basic technical data on some capacitors used for induction heating equipment.





CONFIDENTIAL

Sanitized Copy Approved for Release 2011/09/21 : CIA-RDP80-00809A000700010567-0

Table 3

Technical Characteristics

| Type | Cooling | Voltage (kv) | Capacitance ($\mu$fd) | Power (kvar) | Frequency (cps) | Wt (kg) | Cost per kvar | Notes |
|---|---|---|---|---|---|---|---|---|
| PM 1-0.5 | Natural | 1.0 | 3.84 | 12 | 500 | 14 | 28 | |
| PM 2-0.5 | " | 2.0 | 0.45 | 12 | 500 | 14 | 28 | |
| PM 3-0.5 | " | 3.0 | 0.42 | 12 | 500 | 14 | 28 | |
| PM 1.5-2 | " | 1.5 | 0.42 | 12 | 2000 | 14 | 22 | |
| PMV 1-1 | Water | 1.0 | 11.2 | 70 | 1000 | 25 | 15 | New series |
| PMV $\frac{0.75}{1.5}$-1 | " | $\frac{0.75}{1.5}$ | 29 | 100 | 1000 | 25 | | |
| PMV 2.4-2 | " | 2.4 | 0.98 | 70 | 2000 | 25 | 15 | |
| PMV 1.5-2 | " | 1.5 | 9 | 85 | 2000 | 25 | 15 | |
| PMV 0.66-2.5 | " | 0.66 | 8.8 x 4.4 | 90 | 2500 | 25 | 15 | New series |
| PMV $\frac{0.375}{0.750}$-2.5 | " | $\frac{0.375}{0.750}$ | 58 | 125 | 2500 | 25 | -- | New series |
| PMV $\frac{0.750}{1.5}$-2.5 | " | $\frac{0.750}{1.5}$ | 16 | 125 | 2500 | 25 | -- | New series |
| PMV $\frac{0.375}{0.750}$ | " | $\frac{0.375}{0.750}$ | 22 | 150 | 8000 | 25 | -- | |

50X1-HUM

Extensive introduction of high-frequency communication on high-voltage transmission lines and employment of modern high-frequency protection against short circuits called for special high-voltage capacitors. These capacitors are designed for outdoor installations and are connected directly into 110-, 154-, and 220-kv lines. They isolate the high voltage of the transmission lines at normal frequency from equipment intended for telegraph and telephone communications and protective circuits and, consequently, provide safety for the personnel. These capacitors block power-frequency currents. Equipment operating in a frequency range from 50 to 300 kc is used for communications and protective circuits. A capacitor, tuned to resonance at a definite frequency with an inductance connected in series, passes a current at this frequency and, consequently, ensures the operation of the communications or protective equipment. Capacitors for such purposes, although constantly under a power-frequency high voltage, are designed for simultaneous operation at high frequency. For efficient performance of the communications equipment, the capacitance of these capacitors must remain practically constant during temperature and frequency variations. Like other equipment in open substations, they must have proper insulation since they are subject to atmospheric effects and overvoltages.

These requirements complicate design of capacitors for this purpose, especially when we consider that their self-inductance must be made as small as possible.

Figure 2 shows a 110-kv communications capacitor and mounting. It consists of two elements. For 154- or 220-kv insulation, three or four elements would be used. These capacitors, which have excellent electrical characteristics, can be reduced in weight and size by making one element for 110 kv. It is not practical to make them any larger. A capacitor consisting of two interchangeable 110-kv elements is more reliable than one 200-kv element. Moreover, it permits great flexibility in using the elements for both 220- and 110-kv lines and reduces the number of spares needed. Hence there is no justification for trying to make a 220 kv ac capacitor in one element for communications or high-frequency protection.

High-voltage capacitors are required for high-voltage rectifying equipment, cascaded dc generators, testing devices, electron microscopes, X-ray equipment, radio communications, and many other needs. Such condensers are called filters and are intended for continuous operation in rectifier circuits. However, in this case, an ac component will be superimposed. Depending upon the frequency, the effective value of the ac component for these condensers must not exceed a definite percentage of the dc component. These percentages are shown in Table 4.

Table 4

| Frequency of ac Component (cps) | Admissible ac Component (%) |
|---|---|
| Up to 50 | 10 |
| 50 to 300 | 4 |
| 300 to 2,000 | 1.5 |
| 2,000 to 10,000 | 0.7 |

As shown above, from the standpoint of the dielectric load, the operating conditions of filters make it possible to employ working gradients much larger than those selected for capacitors in ac circuits. In the design of these capacitors, no attention need be paid to losses, and there are no heat-dissipation problems. Recent improved design has permitted us to greatly reduce the volume and weight per microfarad of filter condensers (Figure 3).

However, a number of power applications such as the resonance filters of electric traction substations, switchgear for high-voltage dc transmission, and many others require capacitors operating on a high dc voltage with simultaneous superposition of an alternating component. The alternating component may acquire very large values, which creates a heat load in the capacitor. For example, filter condensers for traction substations operating on 4 kv ac must normally operate with a superimposed 50 to 1,500 cps alternating component.

Table 5 shows the voltages and alternating components encountered in traction substations. It follows from the table that these filter capacitors must be designed with consideration for ac operating conditions.

Table 5

| Frequency of ac Component (cps) | Voltage of ac Component (v) | Effective Value of Cur (amp/mfd) |
|---|---|---|
| 300 | 530 | 1 |
| 600 | 368 | 1.44 |
| 900 | 288 | 1.75 |
| 1,200 | 265 | 2 |

To allow for the possibility of overvoltages in the supply lines of electrified railroads, capacitors for this application must be highly reliable. The performance of the 4-kv, 5 $\mu$fd capacitor manufactured for traction substations is satisfactory. But the extensive electrification of railroads and the problem of reducing the space occupied by capacitors in substations and of simplifying their installation make it necessary to build capacitors with considerably greater capacitance. At present, a set of capacitors for one resonance filter consists of 39 units. This number could be reduced by enlarging the individual units and installing additional taps in the capacitor covers.

Even more rigorous demands, namely, operation on a high dc voltage of the order of 100 kv with simultaneous superposition of an ac component of about 40 kv, are imposed on capacitors used in the switching systems of dc transmission lines. The capacitor of this type (Figure 4) has a test voltage of 250 kv. Figure 5 shows a heavy-duty 2.5 $\mu$fd capacitor for 50 kv dc, which can be used when alternating components of up to several hundred cycles are superimposed. The small size of this condenser is noteworthy.

A series of high-voltage pulse capacitors has been developed in which a bakelite cylinder is used instead of a metal casing with porcelain insulators. Pulse capacitors can be used as filter capacitors in X-ray equipment, as voltage dividers, in electron microscope circuits, etc. Their low weight makes possible suspension construction with several capacitors connected in series. They are manufactured with a capacitance of 0.0022 to 0.030 $\mu$fd for voltages from 40 to 300 kv.

Figure 6 shows a 110-kv, 0.022 $\mu$fd capacitor and a 60-kv, 0.03 $\mu$fd capacitor, both of the new series in bakelite cylinders. The weight and size of the new capacitors are only a fraction of that of earlier capacitors with metal containers and porcelain insulators. This can be easily seen from Figure 7. Of course, the cost is also considerably lower.

Soviet high-current capacitor construction has made great progress and has already reached a very high level, especially in the production of high-voltage capacitors. For example, 300-kv, 0.0125 $\mu$fd capacitors have been built in a very compact form: total height 1 m, cylinder diameter 0.250 m. Special condensers have been designed and built for spark-cutting equipment, stabilizers, electric mining locomotives, electric welding, high-power high-voltage oscillatory circuits, and for many other fields of modern engineering.

50X1-HUM

CONFIDENTIAL

CONFIDENTIAL

Methods of Connecting Capacitor Sections

To reduce the cost of capacitors, it is advisable to have a standard section designed for a definite voltage and capacitance. Then, depending on the desired voltage and capacitance, a different number of sections can be utilized. However, it is impossible to do this for both high- and low-voltage capacitors operating in ac circuits. There are fixed boundaries for sections intended for low and high voltage. In low-voltage capacitors, the sections are generally connected in parallel.

Assuming a working gradient of 12 kv/mm and paper 8 microns thick, two layers are more than sufficient for 220-v capacitors and three layers for 380-v capacitors. In practice, however, at least three layers are used because of the probability of weak spots in the paper coinciding. Hence, three layers are employed for 220-v high-current condensers and four layers for 380 and 500 v.

In the selection of a high-voltage section, attention must be paid to the influence of the nonuniform field at the edges of the foil when the thickness of the layer is increased. It is obvious that, depending on the working voltage, a certain number of groups of sections will be connected in series with sections connected in parallel within the group. Previously, the consensus of opinion was that sections should not be connected in series for capacitors operating in high-voltage rectifier circuits. The argument for this opinion was that the distribution of a dc voltage is inversely proportional to the conductances. It was feared that there would be a breakdown in the capacitors because of the unequal conductances of the individual sections after impregnation. At present, however, we have succeeded in using series connection of sections not only for capacitors operating in ac circuits but even for those used in high-voltage rectifier circuits. This makes it possible to use machine-wound sections, to cut down the size, and thus to design and produce 300-kv condensers in a single casing.

Conclusions

The restoration and development of the national economy of the USSR envisaged in the Five-Year Plans calls for the following measures in Soviet capacitor construction in order to satisfy the requirements of high-current engineering:

1. Broadening the nomenclature of capacitors in production to correspond to the requirements of industry and scientific institutions by developing new types.

2. Improvement of capacitor characteristics by better specifications for individual parts and improvements in design and production.

3. Improvement of performance by reducing the weight and size of capacitors and by studying statistics on their operation.

4. Maximum unification and standardization of capacitor units and parts and reduction of the number of sizes produced.

5. Encouragement of more extensive laboratory research and use of experimental departments of capacitor plants to obtain quicker and better results in mastering and introducing new methods.

6. Design and manufacture by the machine-building industry of single-operation equipment for producing high-current capacitors.

7. Collection of data on the behavior, service life, and causes of breakdown of capacitors for power-factor improvement.





CONFIDENTIAL

Sanitized Copy Approved for Release 2011/09/21 : CIA-RDP80-00809A000700010567-0

CONFIDENTIAL

50X1-HUM

CONFIDENTIAL

Industrial capacitor construction is a comparatively new field. The rising demand for specialists is an indication of the great importance of scientific research in this development. Research should concentrate on the following lines:

1. Study and improvement of the drying and impregnating process to establish the optimum temperature and vacuum conditions and the sequence and duration of their changes in order to cut down the total time required for the process.

2. Study and introduction of methods for checking the course of the drying and impregnating process according to changes in the electrical parameters of the capacitor and development of equipment for this purpose.

3. Study of the feasibility of using high-frequency currents to speed up the drying process.

4. Modernization of equipment for the drying and impregnating process.

5. Verification of data obtained on the use in high-current capacitors of new impregnants, particularly chlorinated substances of the pentachlorodiphenyl type with various stabilizing admixtures and additives to increase the dielectric constant.

6. Research on and evaluation of the use of semiconducting liquids to impregnate low-voltage ac capacitors.

7. Research on the utilization of metallized paper for high-current capacitors.

8. Exhaustive research on the physical and electrical parameters of condenser papers, transformer oil and sovol with a view toward developing new specifications for the construction of high-grade condensers with stable parameters and good technical and economic characteristics.

9. Establishment of criteria for computations and analysis of capacitor design and production. This is especially important in calculating capacitor parameters, such as capacitance and loss angle, in relation to production procedure when the parameters of the paper and impregnant, i.e., capacitance and loss angle before impregnation, are known.

10. Determination of causes for breakdown during testing and operation and development of a theory of capacitor breakdowns.

11. Study of the aging and life of capacitors under various operating conditions.

12. Experimental determination and selection of the most efficient working gradients for various capacitor types and operating conditions.

13. Comparative study of various capacitor designs; determination of conditions resulting in capacitors having the best possible characteristics with regard to volume, cooling surface, and weight per kva.

14. Improvements in various structural parts -- section, casing, terminals, internal assembly, and insulation from the casing.

15. Study of mechanizing assembly processes.

16. Development of improved equipment for the main processes used in capacitor construction, i.e., specialized welding equipment, vacuum cabinets, assembly presses, winding machines, etc.



CONFIDENTIAL

CONFIDENTIAL

50X1-HUM

CONFIDENTIAL

CONFIDENTIAL

50X1-HUM

BIBLIOGRAPHY


1. Morozov, M. M., "Manufacture of Static Capacitors for Power-Factor Improvement," VEP (Vestnik Elektro-Promyshlennosti), No 6, 1934.

2. Morozov, M. M., "Testing the First Consignment of Soviet Static Capacitors for Power-Factor Improvement and a Draft of Specifications for Capacitor Manufacture," VEP, No 9, 1934.

3. Okulov, P. V., "Overheating in Paper and Oil Capacitors," VEP, No 7, 1934.

4. Ivashchenko, O. I., and Morozov, M. M., "The First Installations of Static Capacitors of Soviet Manufacture," Elektrifikatsiya i Elektromonter, No 7, 1935.

5. Morozov, M. M., "Connection of Capacitor Units for Power-Factor Improvement," Elektrichestvo, No 8, 1936.

6. Morozov, M. M., "Protecting High-Voltage Capacitor Compensating Units From Short-Circuit Currents," VEP, No [illegible], 1936.

7. Morozov, M. M., "Importance of Static Capacitors for Power-Factor Improvement," Promyshlennaya Energetika, No [illegible], 1949.

8. Tayts, A. A., and Mesnyayev, B. Z., "Static Capacitors in Operation," Elektromonter, No 6, 1936.

9. Medvedev, S. K., "Characteristics of Capacitors for Power-Factor Improvement at a Frequency of 50 Cycles," VEP, No 8, 1948.

10. Ioganson, N. Ye., "Our Static Capacitors," Elektricheskiye Stantsii, No 5, 1937.

11. Okulov, P. V., "Determining Overheating Temperatures in Oil-Filled Capacitors as a Function of Their Parameters," Sbornik Nauchnykh Rabot Kiyevskogo Industrial'nogo Instituta (Collection of the Scientific Works of the Kiev Industrial Institute), 1935.

12. Grushetskiy, A. N., "Instructions for Operating Static Capacitor Installations for Power-Factor Improvement," Izdatel'stvo Nauchno-Issledovatel'skogo Eksperimental'nogo Proizvodstva Masterskikh Kiyevskogo Industrial'nogo Instituta (Publications of the Scientific-Research and Experimental Production Shops of the Kiev Industrial Institute), 1937.




CONFIDENTIAL

CONFIDENTIAL

50X1-HUM

CONFIDENTIAL

CONFIDENTIAL


13. Gertsenshteyn, M. G., and Sokolova, S. L., "'Sovol' Capacitors," VEP, No 12, 1938.

14. Ayzenberg, B. L., "Testing the Electrical Strength of 6,000-Volt Static Capacitors," Elektromonter, No 2, 1938.

15. Gertsenshteyn, M. G., and Sokolova, S. L., "Oil and 'Sovol' Capacitors," Elektrichestvo, No 3, 1939.

16. Fedchenko, I. K., "Defects in the Terminal Insulators of Static Capacitors," VEP, No 12, 1939.

17. Fedchenko, I. K., "Impulse Strength of Static Capacitors for Working Voltages of 3, 6 and 10 Kv," Elektricheskiye Stantsii, No 10 and 11, 1939.

18. Medvedev, S. K., and Pines, M. N., "Circuits for Measuring Dielectric Losses in Capacitors," Elektrichestvo, No 7, 1939.

19. Medvedev, S. K., "Resistances for Discharging Capacitors," VEP, No 1, 1939.

20. Medvedev, S. K., "Correct Operation of Static Capacitors," Elektromonter, No 5, 1939.

21. Gertsenshteyn, M. G., "'Sovol' Static Capacitors," VEP, No 9, 1942.

22. Renne, V. T., "Modern Capacitor Construction," Elektrichestvo, No 8, 1945.


- E N D -



CONFIDENTIAL

CONFIDENTIAL

Sanitized Copy Approved for Release 2011/09/21 : CIA-RDP80-00809A000700010567-0